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Do's and don'ts

By Chuck Chakrapani

Graphs: The good, the bad, and the misleading

Graphs, to be effective, should take into account the way we perceive visual stimuli. In the past few articles we have discussed the principles that affect visual perception. On that basis we identified graphs that work as intended, graphs that don't work as intended, and graphs that completely distort the patterns inherent in the data.

Computer packages and visual illiteracy

The proliferation of computer based graphic packages has definitely contributed to the proliferation of ineffective and misleading graphs. Computer graphic packages enable anyone to produce attractive looking (not necessarily meaningful or useful) graphs. This has encouraged many researchers to produce graphs of data that are unclear.

Not an all-or-nothing phenomenon

Although we discussed several principles of good graphics, producing good graphs is not purely a scientific exercise. It is both an art and a science. Furthermore, a graph can be good or bad depending on what the producer of the graph intends to convey. The art and science of producing good graphics is not an all-or-nothing phenomenon. One can produce graphs of varying degrees of effectiveness.

Comparing good with the not-so-good

Given all this, we can get better at producing good graphs by comparing good graphs with not-so-good graphs. This way one can be sure that the principles we have discussed so far are not simply theoretical ideas but practical principles. When we apply the principles we end up with graphs that are effective. Towards this end, I have reproduced below a number of commonly produced graphs and tables along with improved versions of the same.

A note on the examples that follow

Each example is designed to illustrate a single principle so the change made to the initial graph is minimal. You may notice that some of the graphs that appear in the 'Do' column later appear in the 'Don't' column. This is because our objective will decide whether a graph is good or bad for that purpose. The 'comments' column explains the principle that makes the graph effective.

Researching visual presentations

Until recently not much material was available on the subject of how to produce effective graphs. However, many of the ideas illustrated here were inspired by the recently published works of others who have been exploring the area of visual presentation for a number of years. Recent books in this area are listed at the end of this article.

The do's and don'ts discussed in this article are based on descriptions of graphs found in a variety of sources. Prominent among them are

Don't

Income distribution in 3 cities

	Income		
	<40K	**40K-60K**	**61K+**
City A	20%	40%	20%
City B	35%	15%	50%
City C	33%	34%	33%

Do

Income distribution in 3 cities

	Income		
	<40K	**40K-60K**	**61K+**
	%	%	%
City A	20	40	20
City B	335	15	50
City C	33	34	33

Comments

The example on the left aligns the row heading at the top rather than at the bottom. This traps the white space between the row heading and the data. In addition, the % notation clutters the table. The table on the right eliminates both of these problems, making the table more readable.

Don't

Income distribution in 3 cities

	Income		
	<40K	**40K-60K**	**61K+**
	%	%	%
City A	20	40	20
City B	335	15	50
City C	33	34	33

Do

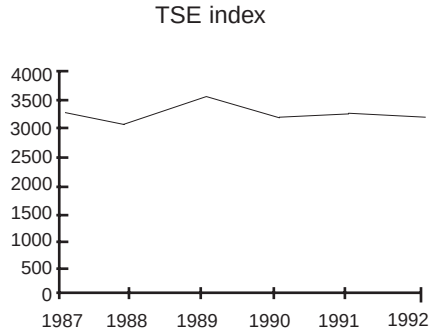
Income distribution in 3 cities

	Income		
	<40K	**40K-60K**	**61K+**
	%	%	%
City A	20	40	20
City B	335	15	50
City C	33	34	33

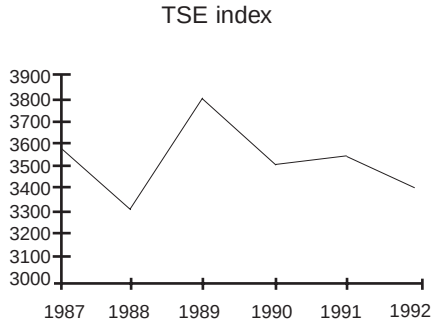
Comments

Gridlines distract the reader and the eye is not guided to travel in any specific direction. It is best not to use gridlines unless there is a specific reason. For instance the example on the right uses horizontal lines to call attention to the fact that the percentages are horizontal and not vertical.

Don't



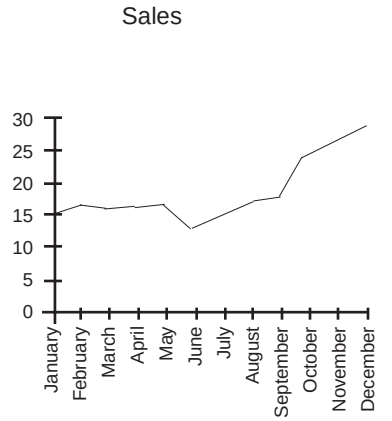
Do



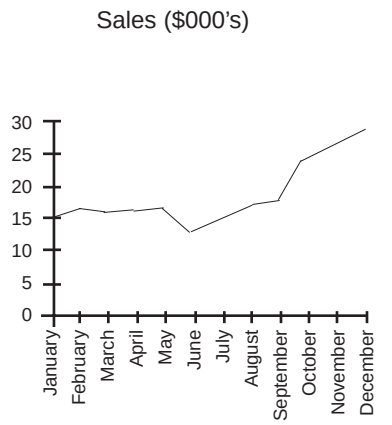
Comments

There is a common belief that all graphs should include the 0-point so the graph is not distorted. However, this does not make very much sense in many situations. For instance the plot of the TSE Index on the left is pointless. It does not clearly show the year-to-year fluctuations. Not including the 0-point might exaggerate minor differences. But including the 0-point can at times hide significant fluctuations.

Don't



Do

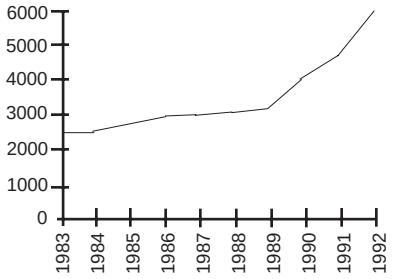


Comments

The chart on the left uses variable labels that are too long. This practice uses up space and creates clutter. The chart on the right is cleaner and the axis points are easy to comprehend.

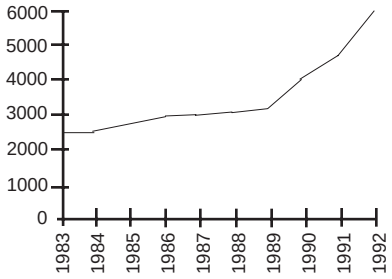
Don't

Annual sales (1983-1992)



Do

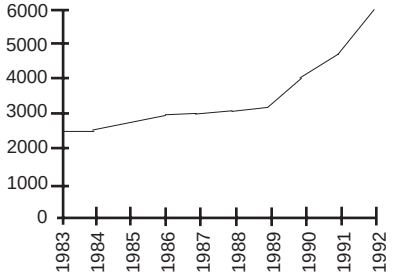
Sales show a sharp increase since 1990



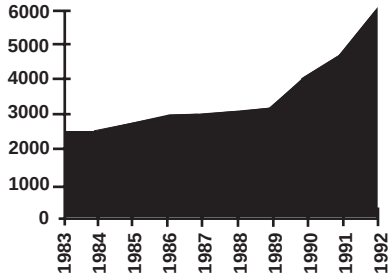
Comments

The title of the chart on the left restates the obvious. The heading can be used to summarize the point which the chart is trying to illustrate.

Sales show a sharp increase since 1990



Sales show a sharp increase since 1990



If your objective is to emphasize a robust sales growth especially since 1990, you may want to use an area graph as shown on the right. While area charts are not inherently superior to line charts, they convey stability and strength. Therefore,t hey can be effective in situations where we need to convey these attributes.

Average attribute ratings

	A	B	C	D
Good quality	2.9	4.7	5.5	7.6
Reasonably priced	2.2	4.8	5.6	7.5
Reliable	2.4	4.8	5.9	7.8
Readily available	2.6	4.2	5.1	7.4
No side effects	2.3	4.1	5.0	7.1
Lasts longer	2.5	4.0	5.3	7.2
Consistent	2.9	4.9	5.7	7.7
Right strength	3.1	4.6	5.8	7.6
Variety of sizes	3.2	4.9	5.5	7.9
Good for me	2.1	4.0	5.2	7.0
Okay for kids	2.0	4.1	5.4	7.4
Can be taken daily	2.3	4.3	5.3	7.1

Average attribute ratings

	A	B	C	D
Good quality	2.9	4.7	5.5	7.6
Reasonably priced	2.2	4.8	5.6	7.5
Reliable	2.4	4.8	5.9	7.8
Readily available	2.6	4.2	5.1	7.4
No side effects	2.3	4.1	5.0	7.1
Lasts longer	2.5	4.0	5.3	7.2
Consistent	2.9	4.9	5.7	7.7
Right strength	3.1	4.6	5.8	7.6
Variety of sizes	3.2	4.9	5.5	7.9
Good for me	2.1	4.0	5.2	7.0
Okay for kids	2.0	4.1	5.4	7.4
Can be taken daily	2.3	4.3	5.3	7.1

When there are a number of columns in a table, it is difficult to follow without visual guides. LOne can achieve this by breaking up the table using lines, spaces or different visual backgrounds (as shown in the chart on the right). While the chart here illustrates the point, visual breaks assume greater importance as the number of columns increases.

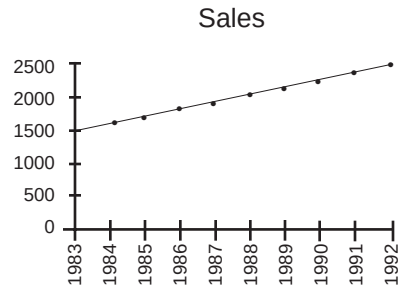
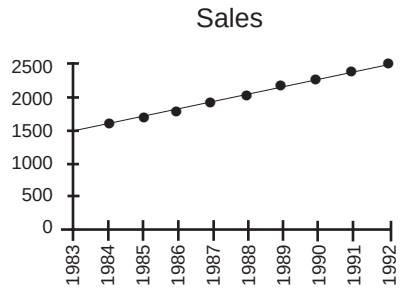
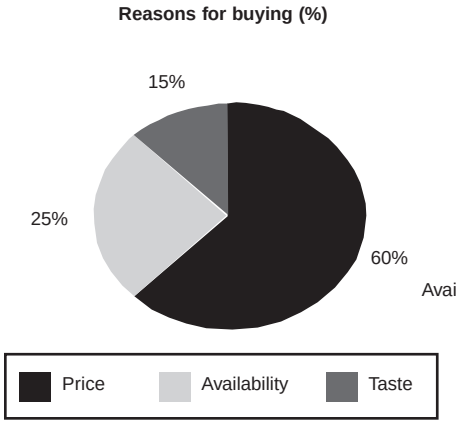
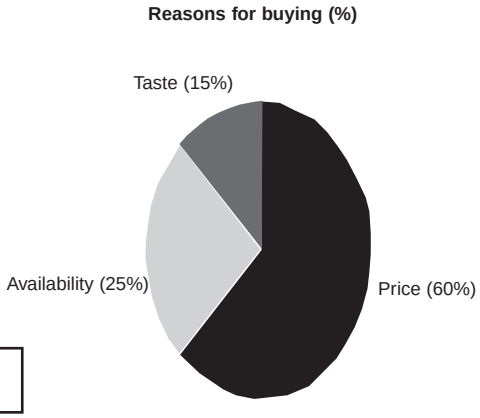
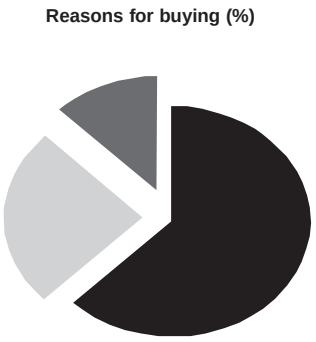
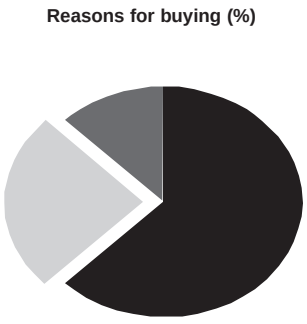
Average attribute ratings

	A	B	C	D
Good quality	2.9	4.7	5.5	7.6
Reasonably priced	2.2	4.8	5.6	7.5
More reliable than other products	2.4	4.8	5.9	7.8
Readily available	2.6	4.2	5.1	7.4
No side effects	2.3	4.1	5.0	7.1
Lasts longer	2.5	4.0	5.3	7.2
Consistent	2.9	4.9	5.7	7.7
Right strength	3.1	4.6	5.8	7.6

Average attribute ratings

	A	B	C	D
Good quality	2.9	4.7	5.5	7.6
Reasonably priced	2.2	4.8	5.6	7.5
More reliable	2.4	4.8	5.9	7.8
Readily available	2.6	4.2	5.1	7.4
No side effects	2.3	4.1	5.0	7.1
Lasts longer	2.5	4.0	5.3	7.2
Consistent	2.9	4.9	5.7	7.7
Right strength	3.1	4.6	5.8	7.6

The chart on the left uses an inappropriate break to accommodate the row title. Since breaks tend to guide the eye of the reader, it is preferable to shorten the title rather than include an artificial break. Use a footnote to provide the full title.

Don't	Do	Comments
		Make sure that the prominent elements of the chart stand out. If it is important for the reader to know the sales for each year, the points should stand out (as in the chart on the right). Do not let the line obscure the data points. This is particularly important if you have more than one line and the lines overlap.
		The chart on the left is difficult to read. The reader has to constantly refer to the legend underneath to understand the relationship between the percentages and the attributes. The graph on the right is visually easier to grasp.
		The purpose of an exploding pie chart is to call attention to the specific slice of the pie. The chart on the left serves no sensible purpose. It neither effectively calls attention to the relative sizes nor calls attention to a specific slice. The chart on the eh right calls attention to a specific slice of the pie.

• *Roger C. Parker's One Minute Designer* by Roger C. Parker. Published by Que Corporation, Carmel: Indiana, 1993.
• *The Elements of Graphing Data* by William S. Cleveland. Published by A.T.&T. Bell Laboratories, Murray Hill: New Jersey, 1994.
• *Elements of Graph Design* by S.M. Kosslyn. Published by W.H. Freeman, New York, 1994.

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